CLAIMS

What is claimed is:

1. A method for selective sintering a powder, comprising the steps of:

spreading a layer of a powder blend on a platform, said powder blend comprising:

a titanium base metal or an alloy thereof, and

an alloying metal having a lower melting temperature than that of said base metal or alloy thereof;

directing an energy beam onto selected areas of said powder blend layer and thereby melting said alloying metal; and

re-solidifying said alloying metal by withdrawing said energy beam from said powder blend layer, and thereby binding said base metal or alloy thereof with said alloying metal.

2. The method according to claim 1, wherein said alloying metal comprises elemental tin.

3. The method according to claim 2, wherein said tin is included in said powder at a concentration ranging between about 5 wt.% and about 15 wt.%.

4. The method according to claim 2, wherein said step of directing an energy beam heats said selected areas of said powder blend to a temperature less than about 1700 °F.

5. The method according to claim 2, wherein said step of directing an energy beam heats said selected areas of said powder blend to about 449 °F.

6. The method according to claim 1, wherein said alloying metal comprises a Ti-Cu-Ni alloy at a concentration ranging between about 10 wt.% and about 30 wt.%, said Ti-Cu-Ni alloy being about 15% Ni and about 15% Cu, with the balance being Ti.

7. The method according to claim 6, wherein said step of directing an energy beam heats said selected areas of said powder blend to about 1700 °F.

8. The method according to claim 1, wherein said powder blend does not include a carbon-based polymer.

9. A method for fabricating a metal part, comprising the steps of:

spreading a layer of a powder blend on a platform, said powder blend comprising:

a titanium base metal or an alloy thereof, and

an alloying metal having a lower melting temperature than that of said base metal or alloy thereof;

melting selected areas of said alloying metal by directing an energy beam onto selected areas of said powder blend layer;

re-solidifying said alloying metal by withdrawing said energy beam from said powder blend layer, and thereby binding said base metal or alloy thereof with said alloying metal;

building up a preform part by iteratively performing said spreading, melting, and re-solidifying steps on additional adjacently formed powder blend layers; and

performing a metal liquid phase sintering process, to form said metal part from said preform part, at a temperature sufficient to melt said alloying metal but not said base metal or alloy thereof.

10. The method according to claim 9, wherein said alloying metal comprises elemental tin.

11. The method according to claim 10, wherein said tin is included in said powder at a concentration ranging between about 5 wt.% and about 15 wt.%.

12. The method according to claim 11, wherein said step of directing an energy beam heats said selected areas of said powder blend to a temperature less than about 1700 °F.

13. The method according to claim 11, wherein said step of directing an energy beam heats said selected areas of said powder blend to about 449 °F.

14. The method according to claim 9, wherein said alloying metal comprises a Ti-Cu-Ni alloy at a concentration ranging between about 10 wt.% and about 30 wt.%, said Ti-Cu-Ni alloy being about 15% Ni and about 15% Cu, with the balance being Ti.

15. The method according to claim 14, wherein said step of directing an energy beam heats said selected areas of said powder blend to about 1700 °F.

16. The method according to claim 9, wherein said powder blend does not include a carbon-based polymer.

17. The method according to claim 9, wherein each of said powder blend layer is between about 0.010 inch and 0.002 inch in thickness.

18. The method according to claim 9, further comprising:

performing a hot isostatic pressure process on said metal part after performing said metal liquid phase sintering and isothermal solidification process, and thereby causing said metal part to have a substantially homogenous structure.

19. The method according to claim 18, wherein said hot isostatic pressure process is performed at about 1800 °F in an inert environment at about 1500 psi.

20. A powder blend for forming metallic parts in a layer-by-layer technique with each layer of said metallic parts being formed in accordance with a CAD file, the powder blend comprising:

a titanium base metal or an alloy thereof, and

an alloying metal having a lower melting temperature than that of said base metal or alloy thereof.

21. The powder blend according to claim 20, wherein said alloying metal comprises elemental tin.

22. The powder blend according to claim 21, wherein said tin is included in said powder blend at a concentration ranging between about 5 wt.% and about 15 wt.%.

23. The powder blend according to claim 20, wherein said alloying metal comprises a Ti-Cu-Ni alloy at a concentration ranging between about 10 wt.% and about 30 wt.%, said Ti-Cu-Ni alloy being about 15% Ni and about 15% Cu, with the balance being Ti.

24. The powder blend according to claim 20, wherein said powder blend does not include a carbon-based polymer.